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The herbicide Zypar™ with the new active ingredient Arylex™ as tankmix partner for graminicides for spring application in cereals

Das Herbizid Zypar™ mit dem neuen Wirkstoff Arylex™ als Tankmischpartner für Gräserherbizide in Wintergetreide im Frühjahr.

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Abstract

Spring applied graminicides often show an insufficient efficacy against dicotyledonous weeds. Therefore tankmix partners are used to gain more control against these weeds.

Development trials were conducted in Germany, France and the United Kingdom from 2014 to 2017 to test the biological compatibility of Zypar™ herbicide and different graminicides against *Alopecurus myosuroides* (ALOMY), *Apera spica-venti* (APESV) and *Bromus sterilis* (BROST).

The herbicide Zypar™ provides a broad efficacy against dicotyledonous weeds and because of its auxinic like active ingredient and its OD-formulation it also proved to be an ideal tankmix partner for graminicides. In addition, the adjuvant (MSO-Type) incorporated in Zypar™ increases the efficacy against broadleaf weeds and grasses. No antagonisms between Zypar™ and graminicides were observed in the field trials. In some cases the mixture of Zypar™ and a graminicide even provided a higher efficacy against grasses compared to the graminicide applied alone.

The safener Cloquintocet-Mexyl which is incorporated in the formulation of Zypar™ enhances the metabolisation of Arylex™ active in the crop. In some cases the selectivity of graminicides could be significantly improved by the addition of Zypar™ even when liquid ammonium urea fertilizer was added to those mixtures.

Keywords: ALOMY, APESV, Arylex™, graminicide, tankmix, Zypar™

Zusammenfassung

Die gegen Ungräser im Frühjahr zugelassenen Herbizide haben häufig eine auf dikotyle Unkräuter unzureichende Wirksamkeit. Daher werden in der Regel Tankmischpartner genutzt, um eine breitere Wirkung auch gegen Unkräuter zu erreichen.

In den Jahren 2014-2017 wurden in Deutschland Feldversuche durchgeführt, um die biologische Kompatibilität zwischen dem Getreideherbizid Zypar™ und verschiedenen Graminiziden zur Bekämpfung von Ackerfuchsschwanz, Windhalm und Taube Trespe zu überprüfen.

Das Herbizid Zypar™ zeigt nicht nur eine sehr breite Wirksamkeit gegen dikotyle Unkräuter, sondern erwies sich aufgrund seines auxin-ähnlichen Wirkstoffs und der OD-Formulierung auch als idealer Mischpartner für Graminizide. Zusätzlich unterstützt Zypar™ durch das in die Formulierung eingebaute Netzmittel (MSO-Typ) die Wirkung gegen Unkräuter und Ungräser. In den Feldversuchen wurde kein Antagonismus zwischen Zypar™ und den Graminiziden beobachtet, in mehreren Fällen konnte sogar eine verbesserte Wirkung der Graminizide auf die getesteten Ungräser nachgewiesen werden.

Durch den im Zypar™ enthaltenen Safener Cloquintocet-Mexyl wird der metabolische Abbau von Arylex™ in der Kulturpflanze unterstützt. Es konnte auch beobachtet werden, dass die Verträglichkeit von Gräserherbiziden ebenfalls verbessert wird. Hierdurch konnte in Einzelfällen, auch nach Zumischung von AHL, die Verträglichkeit der getesteten Gräserherbizide signifikant erhöht werden.

Stichwörter: ALOMY, APESV, Arylex™, Graminizid, Tankmischung, Zypar™

Introduction

Spring applied graminicides often show an insufficient efficacy against dicotyledonous weeds. Therefore tankmix partners are used to achieve more control against these weeds.

Zypar™ is a new broad-leaf herbicide which contains Arylex™ active (6 g ae/L, halauxifen-methyl) and florasulam (5 g ae/L). It controls highly efficaciously a broad spectrum of dicotyledonous weeds. Along with the OD-formulation, Zypar™ herbicide is an ideal tankmix partner for

graminicides. The incorporated adjuvant (methylated seed oil = MSO-type) in Zypar™ supports uptake of the active ingredients and thus makes the control of broad-leaf weeds more robust and also increases the efficacy of graminicides against grasses in some cases. The safener cloquintocet-mexyl, which is incorporated in the formulation of Zypar™, provides a good selectivity over a wide range of crop stages (BBCH 13-45). In addition, tankmixes of Zypar™ with graminicides were frequently more selective to the crop than the graminicide applied alone.

Furthermore, the tankmix of Zypar™ and ALS-graminicides is intended to reduce the risk of resistances to dicotyledonous weeds because Zypar™ contains the synthetic auxine Arylex™ which is an adequate alternative compared to ALS-herbicides to control several weeds.

Materials und Methods

Numerous field trials were conducted in 2014-2017 in Germany, France and the UK internally by Dow AgroSciences and by the German Plant Protection Service in accordance with GEP. The trials were set up with four replicates; the plot size was 15-30 m². Weed control was assessed 2, 4 and 8-10 weeks after application. Phytotoxic assessments of the cereal crops were started one week after application and continued until symptoms were not longer visible anymore. The weed control was rated visually as percentage control or using selectivity compared to the untreated plots.

Zypar™ was applied at 1.0 L/ha in tankmix with three different graminicides, GF-1274 (pyroxsulam 75 g ai/kg), Graminicide A (iodosulfuron 6 g ai/kg + mesosulfuron 30 g ai/kg) and Graminicide B (pinoxaden 50 g ai/L). GF-1274 and Graminicide A were always applied in combination with an adjuvant.

Tab. 1 Characteristics of Zypar™.

Tab. 1 Produktprofil Zypar™.

Characteristics of Zypar™		
Active ingredients	Arylex™ 6 g ae/L +	Florasulam 5 g ai/L
Crops		Winter- and Spring cereals, not approved for the application in oats
Target dose rate	1.0 L/ha 0.75 L/ha	Winter- and Spring cereals (spring application) Winter Cereals (autumn application)
Application timing	BBCH 13-45 BBCH 13-39	Winter cereals Spring cereals
Mode of action	Auxin-like (HRAC O)	Acetolactate synthase inhibitor (ALS, HRAC B)

Results

The tankmixes of Zypar™ and graminicides were tested between crop stages BBCH 16-32 in winter cereals. Applications were carried out against *Alopecurus myosuroides*, *Apera spica-venti* and *Bromus sterilis*.

Alopecurus myosuroides (ALOMY)

For the control of *Alopecurus myosuroides* Zypar™ herbicide was applied in tankmix with two different ALS-graminicides, with Graminicide A applied at 300 or 400 g/ha or with GF-1274 applied at 250 g/ha.

Generally, there was no antagonism observed between Graminicide A and Zypar™. In the trials where graminicide A was applied straight at 300 g/ha the efficacy reached 99% control against the grass. When tank-mixed with 1.0 L/ha Zypar™ the efficacy against ALOMY showed the same level of control (Fig. 1). In other trials where graminicide A was applied at 400 g/ha, the efficacy against *Alopecurus myosuroides* reached 94%. In the mixture with Zypar™ (1.0 L/ha) and graminicide A (400 g/ha) the control of ALOMY was slightly increased (96% control) when compared to the straight application of the grasskiller (Fig. 1).

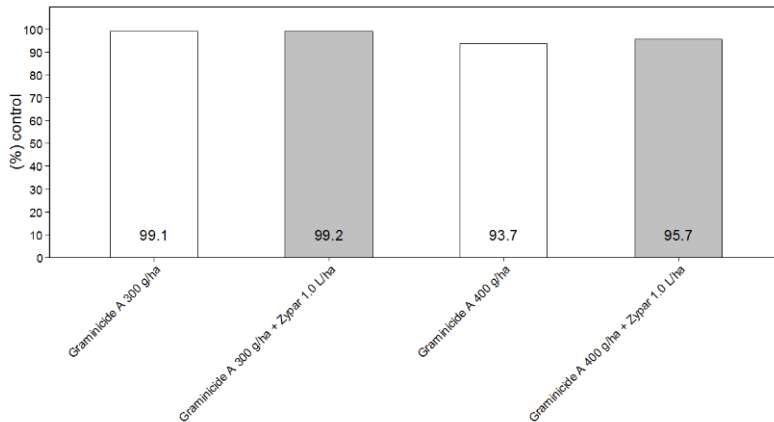


Fig. 1 Efficacy of tankmixes between Zypar™ and Graminicide A (300 and 400 g/ha+ 0.6 resp. 0.8 L/ha adjuvant) against *Alopecurus myosuroides*, assessments 8 weeks after application (n=3 trials/ Graminicide A 300 g/ha and n=3 trials/Graminicide A 400 g/ha).

Abb. 1 Wirkungsgrade der Tankmischungen von Zypar™ und Graminizid A (300 oder 400 g/ha + 0.6 bzw. 0.8 L/ha Netzmittel) *Alopecurus myosuroides*, Bonitur 8 Wochen nach Applikation (n=3 trials/ Graminicide A 300 g/ha and n=3 trials/Graminicide A 400 g/ha).

The mixture of GF-1274 and Zypar™ showed also compatibility in terms of control to ALOMY. Both, the tankmix of GF-1274 plus Zypar™ as well as GF-1274 solo provided 95% control of the grass (Fig. 2).

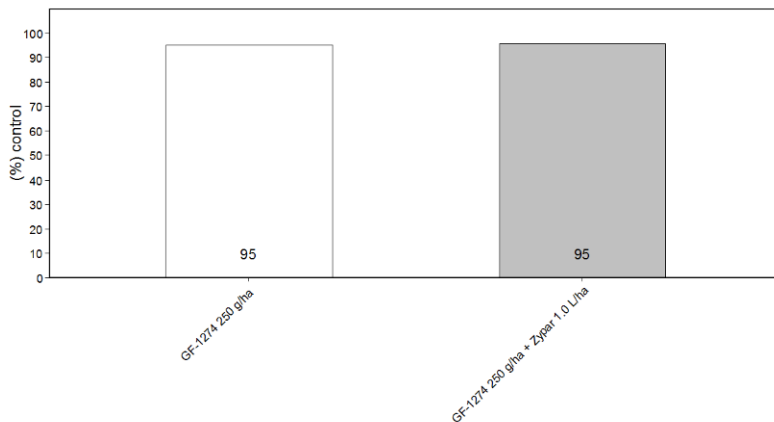


Fig. 2 Efficacy of tankmixes between Zypar™ and GF-1274 (250 g/ha + 1.0 L/ha adjuvant) against *Alopecurus myosuroides*, assessment 8 weeks after application, (n= 4 trials).

Abb. 2 Wirkungsgrade der Tankmischungen von Zypar™ und GF-1274 (250 g/ha + 1,0 l/ha Netzmittel) gegen *Alopecurus myosuroides*, Bonitur 8 Wochen nach Applikation, (n=4 trials).

Apera spica-venti (APESV)

In the APESV trials Zypar™ herbicide was applied in tankmix with Graminicide A at 150 g/ha, Graminicide B at 0.9 L/ha and with GF-1274 at 120 g/ha.

All tested tankmixes did not exhibit any antagonism in controlling *Apera spica-venti* but did demonstrate high level of efficacy: The tankmix of 150 g/ha of Graminicide A and Zypar™ as well

as Graminicide A applied straight provided 95% control against APESV. 120 g/ha of GF-1274 achieved 99% control in tankmix and when applied solo. Graminicide B provided 99% applied straight and as well 99% in combination with 1.0 L/ha Zypar™ (Fig. 3).

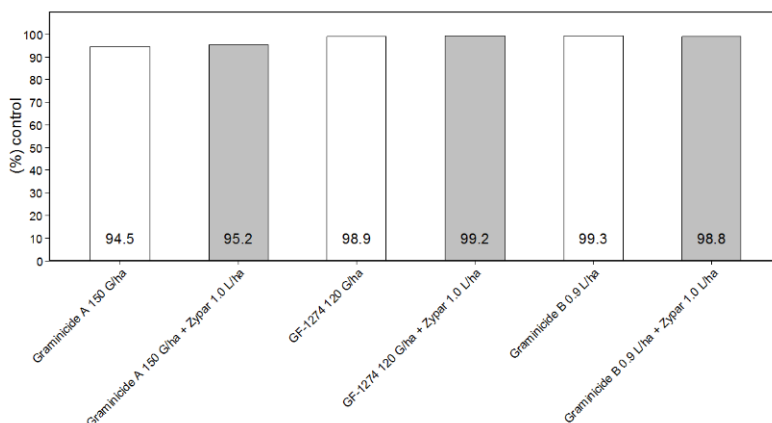


Fig. 3 Efficacy of tankmixes between Zypar™ and Graminicide A (150 g/ha + 0.6 L/ha adjuvant), Graminicide B (0.9 L/ha) and GF-1274 (250 g/ha + 1.0 L/ha adjuvant) against *Apera spica-venti*, assessment 8 weeks after application, (n=3 trials).

Abb. 3 Wirkungsgrade der Tankmischungen von Zypar™ mit Graminizid A (150 g/ha + 0,6 l/ha Netzmittel), Graminizid B (0,9 l/ha) und GF-1274 (250 g/ha + 1,0 l/ha Netzmittel) auf *Apera spica-venti*, Bonitur 8 Wochen nach Applikation, (n=3 trials).

Bromus sterilis (BROST)

In the BROST trial, Graminicide A at 500 g/ha and GF-1274 at 250 g/ha were applied straight and in mixture with 1.0 L/ha Zypar™ herbicide. It was shown that the efficacy of both graminicides against *Bromus sterilis* was improved with the addition of 1.0 L/ha of Zypar™.

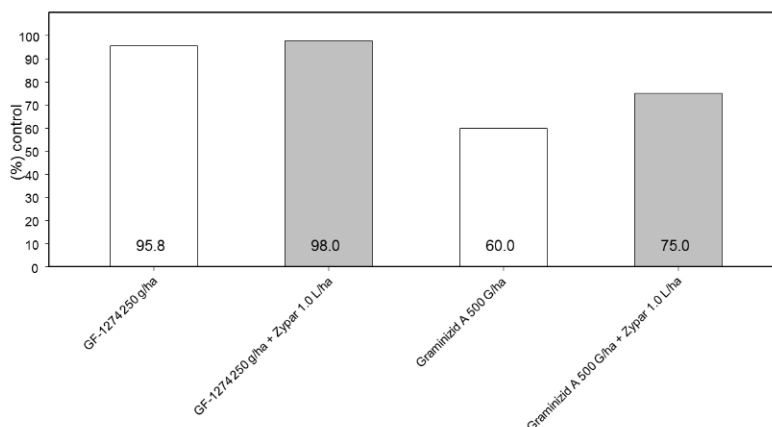


Fig. 4 Efficacy of tankmixes between Zypar™ and Graminicide A (500 g/ha + 1.0 L/ha adjuvant) and GF-1274 (250 g/ha + 1.0 L/ha adjuvant) against *Bromus sterilis*, assessment 8 weeks after application, (n=1 trial).

Abb. 4 Wirkungsgrade der Tankmischungen von Zypar™ mit Graminizid A (500 g/ha + 1,0 l/ha Netzmittel) und GF-1274 (250 g/ha + 1,0 l/ha Netzmittel) auf *Bromus sterilis*, Bonitur 8 Wochen nach Applikation, (n=41 trial).

GF-1274 applied solo achieved 95% control of BROST. The tankmix of GF-1274 with Zypar™ increased the efficacy level to 98%. Graminicide A applied straight at 500 g/ha controlled 60% of the grass. The mixture with Zypar™ improved the efficacy up to 75% (Fig. 4).

Selectivity

The selectivity of the tested graminicides applied straight or in tank-mix with Zypar™ herbicide was also assessed in all trials. The addition of Zypar™ did not negatively impact the crop when compared to the graminicide applied solo. In 6 trials the tankmix between Zypar™ and Graminicide A even improved the crop selectivity. In these cases the addition of Zypar™ resulted in less growth inhibition and necrosis compared to the straight applied graminicides.

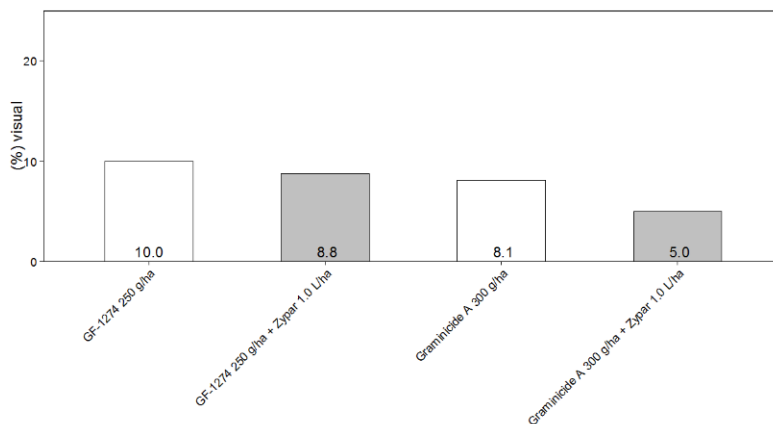


Fig. 5 Selectivity (necrosis) of Zypar™ (1.0 L/ha) in tankmix with GF-1274(250 g/ha + 1.0 L/ha adjuvant) and Graminicide A (300 g/ha + 0.6 L/ha adjuvant), assessment 2 weeks after application, n=2 trials.

Abb. 5 Selektivität (Nekrose) von Zypar™ (1,0 l/ha) in Tankmischung mit GF-1274 (250 g/ha + 1,0 l/ha Netzmittel) und Graminizid A (300 g/ha + 0,6 l/ha Netzmittel), Bonitur 2 Wochen nach Applikation, n=2 trials.

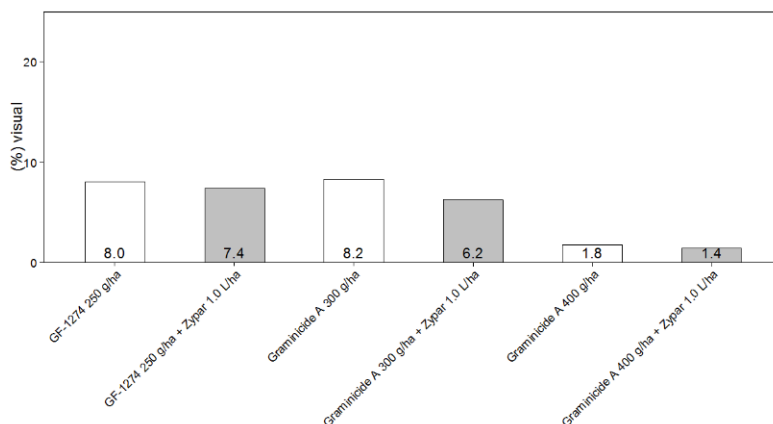


Fig. 6 Selectivity (growth inhibition) of Zypar™ (1.0 L/ha) in tankmix with GF-1274(250 g/ha + 1.0 L/ha adjuvant) or Graminicide A (300 or 400 g/ha + 0.6 or 0.8 L/ha adjuvant), assessment 2 weeks after application, n=4 trials.

Abb. 6 Selektivität (Wuchshemmung) von Zypar™ (1,0 l/ha) in Tankmischung mit GF-1274 (250 g/ha + 1,0 l/ha Netzmittel) oder Graminizid A (300 bzw.400 g/ha + 0,6 bzw. 0,8 l/ha Netzmittel), Bonitur 2 Wochen nach Applikation n=4 trials.

For the tankmix of 1.0 L/ha of Zypar™ and 250 g/ha of GF-1274, necrosis observed 2 weeks after application was 8.8% and thus slightly less than GF-1274 straight with 10% necrosis. A similar trend was seen in the tank-mix consisting of 300 g/ha of Graminicide A and Zypar™ with 5% necrosis while the solo applied graminicide caused 8.1% plant injuries (Fig. 5).

Plant injury assessed as growth inhibition was rated 7.4% for the tank-mix of 250 g/ha GF-1274 and 1.0 L/ha Zypar™ herbicide 2 weeks after application. The mixtures of Zypar™ with 300 or 400 g/ha of Graminicide A resulted in a growth inhibition of the crop of 6.2% and 1.4%. Tank-mixes and straight applied graminicides (8.2 and 1.8%) did exhibit similar selectivity patterns (Fig. 6). All injury symptoms were transient and completely disappeared in the course of the trial.

Discussion

Zypar™ is a new herbicide containing the active ingredients Arylex™ active and florasulam. Applied in spring, Zypar™ controls a wide spectrum of broadleaf weeds (EPP et al., 2015; DZIKOWSKI et al., 2016). Due to the fact that graminicides often show insufficient efficacy against dicotyledonous weeds, Zypar™ is an ideal tankmix partner for grasskillers.

Zypar™ can be applied safely in mixtures with graminicides. There was no visible negative impact on the crop with the addition of Zypar™. In some cases the herbicide even improved the crop selectivity in tankmixes with graminicides.

It is well known that the mixtures of broadleaf weed herbicides and graminicides often proved to be incompatible. These tankmixes can reduce graminicide efficacy and can induce higher crop damage than the graminicide applied straight. Some ALS-herbicides as well as some auxin-like herbicides can cause insufficient control rates against grasses when applied in mixture with graminicides (COBB and BARNWELL, 1994; MC ELLROY et al., 2006, BAGHESTANI et al., 2007; HASSAN et al., 2008; CHHOKAR et al., 2013).

Regarding the efficacy against ALOMY, APESV or BROST, Zypar™ did not show any negative impact when tankmixed with different graminicides. Due to the OD-formulation of Zypar™ with the adjuvant incorporated the efficacy against grasses increased in some cases. The field trials demonstrated that Zypar™ can provide a higher efficacy in tankmix with ALS-graminicides against *Alopecurus myosuroides* and *Bromus sterilis* compared to solo applied graminicides. As a consequence, Zypar™ does not only provide a broad control spectrum of dicotyledonous weeds, it also stabilizes the efficacy and selectivity of graminicides in a tank-mix.

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